Is sternum fracture a concerning clinical situation?

Sternum Fractures

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Abstract

Aim: In this study, it was aimed to investigate the demographic characteristics of the patients diagnosed with sternum fracture (SF) admitted to our hospital in the last year, the treatments applied, and the etiological factors causing SF.

Material and Methods: Fifty-six patients diagnosed with SF as a result of blunt trauma were retrospectively analyzed. Only cases with blunt trauma and SF were included in the study.

Results: A total of 56 cases, 34 males (60.8%) and 22 females (39.2%), who had thoracic trauma and SF together were included in our study. In 33 (58.8%) cases, a motor vehicle accident was the mechanism with the highest rate of trauma. Rib fracture was most commonly accompanied by SFs in 28 cases (50%). The most common extra-thoracic additional organ injury was extremity fracture at various levels, which was confirmed in 13 cases (23.2%). Twelve (21%) patients with isolated SF were kept under observation in the emergency department and provided with pain relief. These patients were recommended to come for control 5 days later and were discharged. The number of cases we applied medical treatment was 50 (89.2%). There were no deaths directly related to SF.

Discussion: Sternum fracture due to trauma indicates that the trauma is severe. Cases must be evaluated in terms of additional organ injury. Mortality occurs especially in patients with multiple trauma and for reasons other than thoracic. Patients with isolated non-complicated, non-displaced SF do not need hospitalization if there are no additional organ injuries or uncontrolled pain.

Keywords

Blunt thoracic trauma; Hemothorax; Pneumothorax; Sternum fracture

Introduction

Thoracic trauma constitutes approximately 10% of all trauma cases admitted to emergency services [1]. Thoracic injuries constitute approximately 25% of post-traumatic deaths [2]. Sternum fractures (SF) are observed in 3% to 8% of blunt traumas [3]. Most (> 95%) SF recover with conservative treatment. Surgical fixation is indicated in cases of fracture instability, displacement, or nonunion of the fracture [4]. Severe chest pain, shortness of breath, persistent cough, and paradoxical movement of the chest wall may be observed due to unstable or displaced fractures in a few cases [5]. Injuries that can be observed due to SF are more important than the fracture itself [6]. Various outcomes such as pleural effusion, hemothorax, pneumothorax, pericardial effusion, pneumomediastinum, and retrosternal hematoma may occur after SF[1].

There is no consensus regarding the evaluation and the treatment algorithm of SF cases [7]. While lateral chest radiography is sufficient to make a diagnosis, SF can sometimes be overlooked in this examination during the first evaluation of traumatic cases. In the case of localized pain and tenderness on physical examination, the condition of the sternum should be evaluated with serial radiographs [8].

This study aimed to investigate the demographic characteristics of the patients diagnosed with SF admitted to our hospital in the last year, the treatments applied, and the etiological factors causing SF.

Material and Methods

Our study was conducted in accordance with the Declaration of Helsinki and approval was obtained from the institutional clinical research ethics committee (approval date: 27/05/2020, decision no: 2020/10). The files of patients over the age of 18 who applied to the emergency medicine department of a tertiary referral hospital with blunt trauma were reviewed retrospectively. Fifty-six patients who were diagnosed with SF as a result of blunt trauma between May 2019 and May 2020 were analyzed. Only cases with blunt trauma and SF were included in the study.

The patients who did not have a history of blunt trauma and were under 18 years of age were excluded. Also, cases without SF were not included in the study. Information about our cases was accessed through the electronic data recording system of our hospital. Age, gender, trauma mechanism, localization of SF, physical examination findings, accompanying other organ injuries, treatment modalities, length of stay at the hospital, and treatment results were determined.

Posteroanterior and lateral chest radiographs were obtained for all patients following their physical examination at the first admission to our emergency department. Those with an indication were evaluated with computed tomography of the thorax. Electrocardiography (ECG) and echocardiography (ECHO) were performed in all patients with SF, and their cardiac enzyme values were studied. The ECG and cardiac enzyme values of patients with isolated, non-displaced, non-complicated SF have been studied again at intervals of 12-24 hours. Patients with normal cardiac enzyme levels and ECG findings were not hospitalized. The appropriate analgesics were prescribed to them and they were called for control 5 days later. Patients with

complicated SF were hospitalized and treated in appropriate clinics considering the degree of their additional organ injuries.

Statistical analysis

Statistics program for social sciences 20 (SPSS 20) was used for statistical analysis. Numerical data were given as mean ± standard deviation, and categorical variables as frequency and percentage. The Chi-square test was used for categorical data in comparisons between groups. The t-test or Mann Whitney U tests was used for comparison of numerical data between groups. Spearman's correlation analysis was used to determine the correlation. A p- value <0.05 was considered statistically significant.

Results

A total of 56 cases, 34 males (60.8%) and 22 females (39.2%), who had thoracic trauma and SF together were included in our study. The mean age of our cases was 56.6 ± 19.3 (18-100) years. In 33 (58.8%) cases, the mechanism with the highest rate of trauma was a motor vehicle accident (Table 1).

When we summed up falling from trees and animal bumps under one heading, the name of an agricultural accident, we found that it was the highest rate of injury mechanism after traffic accidents with a rate of 23.2%.

We evaluated our cases with no pathological findings other than SF as isolated SF, and cases with additional organ injury as complicated SF. There was no injury other than SF in 16 (28.6%) of our cases. Other accompanying injuries are listed in Table 2. We found that rib fracture was the most commonly accompanied by SFs in 28 cases (50%). Less frequently, lung contusion was determined in 12 cases (21.4%), hemothorax in 9 cases (16%), pneumothorax in 6 cases (10.7%), hemopneumothorax in 5 cases (8.9%), minimal pericardial effusion in 1 case (1.8%). The most common extra-thoracic additional organ injury was extremity fracture at various levels and confirmed in 13 cases (23.2%). Afterward, we found that 9 cases (16%) had intracranial injuries and 3 cases (5.4%) had intraabdominal organ injuries.

Forty (71.4%) of our cases had corpus, 12 (21.5%) had manubrium, 4 (7.1%) had both corpus and manubrium fractures. There were 43 (76.8%) patients with displaced SF and 13 (23.2%) patients with non-displaced SF.

Twelve (21%) patients with isolated SF were kept under observation in the emergency department for not more than 24 hours. The fractures of these patients were non-displaced, cardiac enzymes, ECG, and ECHO findings were normal at the time of the first application. Since the ECG, ECHO, and cardiac enzymes of these patients were within normal limits, which were studied at intervals of 12-24 hours, it was not deemed necessary to hospitalize them. Patients whose pain relief was provided were recommended to come for control 5 days later and were discharged.

A chest tube was inserted in 6 (10.7%) of our cases due to hemothorax, pneumothorax, and hemopneumothorax. The number of cases we applied medical treatment was 50 (89.2%). In none of our cases, surgical stabilization was required.

The mean length of hospital stay for patients with SF was 5.5 ± 5.6 days. The average length of hospital stay according to the mechanism of trauma is given in Table 3. When the patients

were grouped according to the mechanism of trauma, there was a statistically significant difference between the groups in terms of length of stay at the hospital (p = 0.005). It was found that the subjects who had a motorcycle accident (p = 0.030) and out-of-vehicle traffic accident (p = 0.013) were hospitalized for a longer time than the subjects who fell from their level. The mean length of hospital stay was 7.71 ± 7.09 days in patients with extra-thoracic injuries and 4.81 ± 4.96 days in those with thoracic injuries. The length of hospital stay was similar in patients with and without extra-thoracic injuries (p = 0.165).

The frequency of additional organ damage was found to be similar (P = 0.079) among the groups according to the mechanism of trauma. There was no correlation between age and the length of hospital stay (r = -0.087, p = 0.525). The mean age was different in the trauma groups (p = 0.039). The mean age for falling off his/her own level was 73.28 ± 18.15 years and 50.12 ± 16.33 years for in-vehicle traffic accidents. The average age in the group for falling off his/her own level was higher than vehicle traffic accidents (p = 0.046).

Five (8.9%) of the cases with SF died. The causes of death were intracranial injury in 4 (75%) cases and fat embolism due to multiple extremity fractures in 1 (25%) case. There were no deaths directly related to SF.

Table 1. Number of cases in groups formed according to the trauma mechanism

Trauma Mechanism	Female (n) /%	Male (n)/%	Total %
Out-of-Vehicle Traffic Accident	0 (0%)	4 (100%)	4 (7.1%)
In-Vehicle Traffic Accident	11 (44%)	14 (56%)	25 (44.6%)
Falling from high	5 (37.5%)	6 (62.5%)	11 (14.3%)
Falling off his/her own level	5 (71,4%)	2 (38.6%)	7 (12.5%)
Animal bumps	1 (20%)	4 (80%)	5 (8.9%)
Motorcycle accident	0 (0%)	4 (100%)	4 (7.1%)
Total	22 (39.2%)	34 (60.8%)	56 (100%)

Table 2. Injuries accompanying sternum fracture

Type of injury	Number of Cases /%	
Rib Fracture	28	50%
Lung Contusion	12	21.4%
Hemothorax	9	16%
Pneumothorax	6	10.7%
Hemopneumothorax	5	8.9%
Extremity Fractures	13	23.2%
Intracranial Injuries	9	16%
Intraabdominal Organ Injury	3	5.4%
Pericardial Injury	1	1.8 %

Table 3. The average length of stay at the hospital according to the mechanism of trauma

Type of Injury	Length of Stay at the Hospital (days) mean ± std and (min-max)
Out-of-Vehicle Traffic Accident	5.16 ± 5.46 (0-22)
In-Vehicle Traffic Accident	13.75 ± 6.50 (6-20)
Falling from high	3.82 ± 2.76 (0-11)
Falling off his/her own level	1.43 ± 1.81 (0-4)
Animal bumps	5.40 ± 3.05 (3-10)
Motorcycle accident	11.75 ± 6.80 (5-21)

Discussion

Sternum fractures are often caused by thoracic trauma and/or direct blows to the sternum. The most common cause is traffic accidents [7]. In accordance with the literature, 58.8% of SF was caused by motor vehicle accidents in our study. We learned that all of our cases were brought in due to an in-vehicle traffic accident were wearing seat belts. There are many studies reporting that seat belts increase the possibility of SF in motor vehicle accidents. However, considering the severity of the trauma in traffic accidents, we think that SF caused by wearing seat belts is a small cost for survival.

Studies have revealed that SFs are located in the corpus sterni at a rate of 77%-89% [3,9]. The rate of corpus sterni fractures was 71.4% similar to those in our study.

One of the most important factors determining morbidity in SFs is additional organ injuries [10]. Sternum fractures may be accompanied by myocardial contusion, tracheobronchial, pulmonary and vascular injuries, and flail chest depending on the severity of the trauma [11]. In a series of 200 cases done by von Garrel et al., rib fractures were found to accompany SF with a rate of 10.5% [9].

Unlike the literature, the SFs were primarily accompanied by rib fractures with a rate of 50% in our study, hemothorax, pneumothorax, and hemopneumothorax, which frequencies vary between 3% and 20%, are other pathologies accompanying SF [9,12]. In accordance with the literature, hemothorax was found in 16% of the cases, pneumothorax in 10.7%, hemopneumothorax in 8.9%, and tube thoracostomy was applied to 10.7% of them. There were no cases that required surgical fixation.

Due to the possibility of myocardial damage in SFs, cardiac monitorization, ECG, cardiac enzyme and protein (CK-MB and troponin I) level measurements should be performed at 12 and 24 hours [13]. We followed all our cases at the 12 and 24 hours with the cardiac enzyme, ECG, and ECHO considering the literature recommendations. We decided that hospitalization was not necessary for 12 (21%) of our non-displaced, isolated SF patients who had no pathological findings in their ECG, ECHO, and cardiac enzymes. However, we called these cases for control 5 days later. There was no morbidity related to SF in any of the patients discharged. We did not find any case series that were externalized similar to our study in the literature. We found that 24-hour observation was sufficient in cases with isolated, non-displaced SF. We think that the cost is reduced with this approach.

The average length of stay at the hospital in patients with SF is between 2-10 days in the literature [14,16]. The average length of stay at the hospital in our study was 5.5 ± 5.6 days similar to the literature. Some studies reported that the length of stay at the hospital varies statistically significantly with accompanying injuries, while others reported that there is no significant relationship between additional injuries and length of stay at the hospital [12,16]. We found that additional organ injury did not significantly increase the length of stay at the hospital. The low number of patients with additional organ injuries in our study is a limiting factor for this result.

Study Limitations

The main limitations are the low number of patients with

additional organ injuries, being a single-center and retrospective nature of the study..

Conclusions

Sternum fracture due to trauma indicates that the trauma is severe. Cases must be evaluated in terms of additional organ injury. The cardiac enzyme, ECG, and ECHO examinations should be performed for cardiac injury evaluation. The prognosis of isolated SFs is quite good. Mortality occurs especially in patients with multiple trauma and for reasons other than thoracic. Patients with isolated non-complicated, non-displaced SF do not need to be hospitalized if there is no additional organ injury or uncontrolled pain. It will be appropriate to treat accompanying injuries in SFs that require hospitalization. If there is no accompanying injury, follow-up and analgesic treatment are sufficient.

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